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UNITED STATES DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports\*  
for  
SOIL CONSERVATION SERVICE RESEARCH\*\*

DECEMBER 1944



EROSION CONTROL PRACTICES DIVISION

Conservation Experiment Stations Section

L. T. Kardos of Durham, New Hampshire reports: "Greenhouse experiments with subsoil-topsoil mixtures of the Paxton sandy loam indicate a tendency for depression of yield when 25 per cent of subsoil is present in the mixture and a very marked depression in yield when 75 per cent of subsoil is present. Fertilizer treatments indicate phosphorus to be primarily involved in the fertility status which results from the interaction of subsoil and topsoil."

Dwight D. Smith of Columbia, Missouri reports: "Yields of three check plots averaged 28.2 bushels per acre in comparison to 31.4 bushels from the shattered plots, and 44.2 bushels per acre from the shattered and treated plots. Last year, both the shattered and shattered and treated plots also gave significantly increased yields over the check plots, although the difference in favor of the shattered and treated plot was less than this year. Weather conditions this year were ideal to bring out the yield difference for the three conditions.

"Soil losses in tons per bushel of corn produced were calculated for 7 soils in the State, 6 of which were major upland corn producing soils. As an average for the 6 (Marshall, Knox, Grundy, Shelby, Summit and Putnam) 1.8 tons soil was lost for each bushel of corn produced by planting continuously to corn along field boundaries. Changing from continuous corn to a rotation (corn-small grain-meadow) reduced this estimated loss to 0.6 ton per acre. Losses were highest for the Knox, which has the steepest slopes, and the lowest for the Putnam, despite low yields, due to its extremely flat slopes."

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\*\*All Research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

C. J. Whitfield of Amarillo, Texas reports: "Because of relatively low temperatures throughout the month with no warm periods of sufficient length to stimulate growth, winter wheat utilized for grazing provided little forage in addition to that available at the beginning of the period. However, extremely favorable growing conditions earlier in the season promoted sufficient growth to permit continuous grazing of 180 acres of volunteer and early seeded wheat by 110 head of calves throughout the month. Most of the grazing was done on the seeded portion (90 acres) because of considerably less damage by orange leaf rust on this portion of the field. Calves grazing on this area from November 10 to December 31 made a total gain of 8,545 pounds which at current prices would amount to approximately \$1,110.00. The grazing was supplemented with 2,186 bundles of old and new sorghum valued at \$138.00, leaving a net gain of \$972.00, exclusive of labor and overhead. On an acre basis, this would mean \$5.40 per acre return from wheat grazing. This is a source of income that should be judiciously taken advantage of when available and considered as part of the cash value of the wheat crop. During the period of 52 days from November 10 to December 31, calves grazing wheat supplemented with bundle feed made a net gain above feed cost of approximately \$3.00 more per head than calves grazed on native pasture supplemented by 2 pounds of cotton seed cake per head daily.

"Soil nitrate analysis made on three stubble mulch field trials showed very little difference in nitrate nitrogen in the surface 6 inches of soil for the stubble mulch and check areas. As shown by the following table, the nitrate nitrogen was rather low on all fields:

Field	P.P.M. of nitrate nitrogen in the surface 6 inches of soil	
	Stubble mulch	Check
H. E. Miller.....	0.97	0.89
Ed Stallwitz.....	4.73	4.31
Max Blau.....	1.91	1.81

What slight advantage exists in nitrate nitrogen between these areas is in favor of the stubble mulching.

"Gains of steers on native and reseeded pasturage: Summary of second experiment, October 13, 1943 to October 31, 1944.-The Amarillo Soil Conservation Experiment Station has reseeded various grasses in establishing pastures on wind eroded fields. Grasses which have been established include western wheat, blue grama, wild rye, and buffalo grass. Work is being done in cooperation with the Texas Agricultural Experiment Station to determine (1) which grasses will afford the most valuable pasturage, (2) the comparative value of native and reseeded pasturage, and (3) method of livestock and pasture management suitable to the economy of the region. To these ends feeder steer calves are purchased in the fall, wintered, and are then summer grazed on different kinds of pasturage.

"Cattle used.-For the 1943-44 work, 59 Hereford steer calves averaging 482 pounds were purchased from Montgomery Brothers, Vega, Texas, on October 13, 1943, at \$13.50 per cwt. Since wheat pasturage did not materialize, wintering was accomplished on native pasturage plus the conservative use of feeds as cotton seed cake, ground milo grain, and hegari bundles. The average gain from October 13 to April 1, a period of 169 days, was 141 pounds. At the latter date, 50 head averaging 627 pounds, selected from the 59 were divided as equally as possible into 5 groups of 10 head each.

"Pasturage used.-April 1 to October 31, 213 days.

Pasture I-1, Lot 1 steers.-Forty-four acres native pasturage, blue grama and buffalo, good to excellent condition. This pasture had the same general appearance of utilization at the end of the 1944 grazing season as it did in 1943. Grazing was irregular throughout the area with both blue grama and buffalo grass being removed to within an inch of the ground in some places, two to three inches in others, and in many instances there were plants with the appearance of no use. Estimated utilization: Blue grama 45 per cent; Buffalo grass 50 per cent.

"Pasture H-1, Lot 2 steers.-Forty-four acres native pasturage, buffalo, blue grama, western wheat, and lake weeds. The lower half of this pasturage is in the intermittent lake. Barnyard grass appeared to be grazed closer, 60 per cent, than other predominant species such as dwarf fleabane and false ragweed. In the upper half of the pasture, buffalo and blue grama grass were heavily used, approximately 75 per cent, while utilization on western wheat was about 80 per cent. It is of interest to note that blueweed was utilized quite heavily or about 40 per cent.

"Pasture I-2, Lot 3 steers.-Forty-four acres reseeded pasturage principally western wheat and blue grama. The composition and utilization of this pasture is about as follows: blue grama 50 per cent with an estimated utilization of 60 per cent; western wheatgrass 35 per cent and 40 per cent; Canada wild rye 5 per cent and 45 per cent; African lovegrass 3 per cent and 40 per cent; and buffalo grass 2 per cent and 70 per cent. In pure stands blue grama was very heavily used, whereas when growing with other less palatable plants, it was not taken so heavily.

"Pasture F, Lot 4 steers.-Forty-four acres reseeded pasturage, western wheat, Canada wild rye and some weeds plus sudan in September. Estimated utilization was 70 per cent for western wheat and 50 per cent for Canada wild rye. Ten acres were reseeded in April 1944 and dominated by weeds were utilized closely throughout the season.

"Pasture H-2, Lot 5 steers.-Miscellaneous pasturage. Pasture F, April 1 to May 15; lake weeds, May 16 to August 1; sudan, August 1 to October 1, and October 1-31 deferred native pasturage. Intermittent lake weeds used mostly were dwarf fleabane, smartweed, false ragweed and barnyard grass. Mosquitoes and flies were probably partly responsible for the poor showing of this pasture.

"Average daily gain in pounds by months

Item	April	May	June	July	Aug.	Sept.	Oct.	Average 213 dys.
I-1, Lot 1, daily gain	1.60	2.27	1.22	1.71	1.05	1.07	-1.05	1.13
H-1, Lot 2, daily gain	1.75	2.03	1.48	1.37	1.31	1.45	-.06	1.34
I-2, Lot 3, daily gain	1.98	2.40	1.33	1.65	1.31	1.20	.26	1.46
F, Lot 4, daily gain	1.71	1.40	2.03	1.40	1.02	.63	1.45	1.38
H-2, Lot 5, daily gain	1.76	1.24	1.07	-.34	2.13	1.28	2.03	1.36
All lots, daily gain	1.76	1.87	1.43	1.16	1.36	1.13	.09	1.33

"Discussion.-For the April 1 to October 31 grazing period, reseeded pasturage had the advantage over native pasturage. This advantage was gained principally in April and October, indicating that under continuous moderate usage western wheat and wild rye may contribute very materially to both early season and late season feed. At the same time, the gain made by Lot 5 in October on deferred native pasturage show that steers may make late season gain on native pasturage if provided a wide selection of forage. It is rather evident that regardless of type of pasturage, maximum steer gain and finish cannot be realized except under light usage.

"The spring growth of blue grama and buffalo grass had barely started when the steers were turned to the pastures April 1, while western wheat and wild rye were ready for use. This condition was reflected in the gains for April for all lots made higher gain than Lot 1 grazed on the native blue grama, buffalo pasture. All other pastures contained fair to good amounts of western wheat or wild rye.

"Average gains were higher during May than in any other month. June and July gains were practically equal and while lower than in April were higher than in September. In October, Lot 1 lost considerable weight. Lots 2 and 3 were at a standstill in weight but lost in bloom. Lot 4 made an average gain and Lot 5 made above average gain.

"Sudan pasturage during August seemed to increase the rate of gain but in September produced less gain than native pasturage. Lot 5 confined to lake weeds made satisfactory gain for a period of less than 30 days and during July lost weight.

"Lots 1 and 4 grazed respectively on reseeded pastures I-2 and F sold at a higher price and returned carcasses of greater weight than Lots 1 and 2 grazed on native pastures I-1 and H-1. Lot 3 had distinct advantage in carcass yield over Lot 4, the former having principally western wheat and blue grama and the latter western wheat and wild rye. Lot 3 had extreme advantage over Lot 1 in gain and finish and in this case the principal difference in feed was blue grama plus western wheat in the former and blue grama plus buffalo in the latter.

"To summarize: The results for 1944 in steer gains and finish indicate the following order of desirability for the different grass combinations under study:

1. Reseeded pasturage I-2: Western wheatgrass plus blue grama.
2. Reseeded pasturage F: Western wheatgrass plus wild rye.
3. Native pasturage H-1: Blue grama, buffalo, forbs and wheatgrass.
4. Native pasturage I-1: Native blue grama, buffalo grass.

"The fifth treatment, miscellaneous pasturage, accorded Lot 5 steers is not ranked because of acreage involved, although results indicated that opportune grazing has a place and would rank relatively high."

E. C. Richardson of Auburn, Alabama reports:

"Yield of kudzu on eroded Louisa soil as a result of fertilizer and cultural treatments (Plots are located at North Auburn)

Fertilizer treatment	Cultural treatment	Yield of green kudzu per acre		Average yield
		1943	1944	
None	Deep cultivation	1,526	1,744	1,635
600 superphosphate	Deep cultivation	6,758	10,028	8,393
600 superphosphate, 100 muriate	Deep cultivation	5,232	8,284	6,758
None	Shallow cultivation	2,180	3,924	3,052
600 superphosphate	Shallow cultivation	8,502	12,208	10,355
600 superphosphate, 100 muriate	Shallow cultivation	8,066	12,644	10,355
None	No cultivation	1,744	3,052	2,398
600 superphosphate	No cultivation	11,118	14,170	12,644
600 superphosphate, 100 muriate	No cultivation	11,554	13,298	12,426

"Kudzu was planted in 1941. Uniform cultivation was given the first year. Phosphate or phosphate and potash were applied on those areas that were to receive fertilizer treatment. In the spring of 1942, 400 and 50 pounds of superphosphate and muriate of potash, respectively, were applied to those plots that received one or both fertilizers."

John T. Bregger of Clemson, South Carolina reports: "Yield records for the six-year-old orchard block has been summarized. The most important soil management or soil conservation treatments are listed in the following table showing their relative superiority on the basis of fruit yields.

EXPERIMENTAL PEACH ORCHARD  
Clemson, South Carolina

Soil management practices	Average yield per tree in 1944	
	Bushels	
Clean cultivation (no cover crop).....	4.6	
Grain straw mulch.....	4.0	
Sorghum pomace mulch.....	3.6	
Soybeans-Sudan grass, summer cover crop held over as winter mulch.....	3.6	
Kobe lespedeza, continuous cover.....	2.1	
Sericea lespedeza, perennial cover.....	1.8	
Winter cover crop                          Summer cover crop		
Vetch.....	Soybeans.....	4.9
Rye.....	Soybeans.....	3.5
Vetch.....	Crabgrass.....	4.6
Rye.....	Crabgrass.....	3.6
Vetch plots; cover crop residues on surface.....	5.2	
Vetch plots; cover crop residues turned under.....	4.4	
Rye plots; cover crop residues on surface.....	3.9	
Rye plots; cover crop residues turned under.....	3.3	
Soybean plots; cover crop residues on surface.....	4.7	
Soybean plots; cover crop residues turned under...	3.8	
Crabgrass plots; cover crop residues on surface...	4.4	
Crabgrass plots; cover crop residues turned under.	3.8	
Vetch plots; minimum cultivation*.....	4.6	
Vetch plots; 1-1/2 months cultivation.....	4.8	
Vetch plots; 3 months cultivation.....	5.0	
Rye plots; minimum cultivation*.....	3.6	
Rye plots; 1-1/2 months cultivation.....	3.8	
Rye plots; 3 months cultivation.....	3.9	
Vetch plots (all trees).....	4.8	
Rye plots (all trees).....	3.6	
Border trees between vetch plots.....	5.0	
Border trees between rye plots.....	3.4	
Border trees between vetch and rye plots.....	4.3	

"\*Seedbed preparation only."

B. H. Hendrickson of Watkinsville, Georgia reports:

"Soil and water losses and yields of peanuts grown continuously and in rotation on Class II land\* Period Jan.-Nov., 1944

Plots	Crops	Water loss, runoff, pct.	Soil loss tons per acre	Peanut yield, nuts/lbs./acre
Class II land	Continuous peanuts.....	17.1	5.19	1148
Slope, 3 pct.	Vetch green manure turned under, peanuts.....	--	--	1216
Slope length, 105 ft.	Peanuts following crotalaria**.....	15.6	1.87	1850

\*Soil and water losses are from single runoff plots; yields from triplicate plots. Cecil Sandy Loam Soil. Rainfall - 48.31 inches.

\*\*Oats-vetch hay, followed by crotalaria were grown in 1943 and residues turned under. In 1944 rotation peanuts followed.

"With equalized fertilization under peanuts, the crop responded best in 1944 to the after-effects of summer legume residues, thus adding another item to the lengthening list of experimental trends in favor of this method for protecting and improving the soil."

"As our land improves in good conservation-type rotation practices, we are beginning to get lesser differences in yields due to type of tillage tool used. Apparently then, much of the confusion arises from the fact that production levels have a great deal to do with the choice of land preparation implements."

Joel E. Fletcher of Tucson, Arizona reports: "It was observed on some of the more sandy areas that the thin surface layer formed by the beating and sorting action of the rain had become a mass of filamentous growth of an alga resembling oscillatoria and a secondary mold mycelium which was apparently feeding on the alga. The mycelium consolidated the layer to such an extent that it could be peeled off in sheets as large as six inches square by perhaps a millimeter thick which was flexible with a sort of rubbery consistency. The surface buffer formed by this layer renders the soil almost immune to the beating of rain and ravages of sheet erosion."

Alvin E. Lowe of Garden City, Kansas reports: "Again this year difficulty was experienced in obtaining satisfactory stands on the basined plots and this is shown by the low yields obtained in comparison with the higher yields on the non-basined plots. All basined plots averaged 21.3 bushels per acre, non-basined 33.7. It is evident that some drastic corrective measure must be taken and the author is studying the problem and hopes to make suggested changes later.

"The sorghums planted on fallow failed to give the usual large increase in yield over continuous cropping. This was to be expected in a wet year such as this.

"The contoured plots in 1944 out yielded the non-contoured plots but not by as high a percentage as usual. The average of all the contoured plots for the past five years is 17.8 bushels. The average of all the 'up and down slope' plots for the past five years is 14.0 or an increase of 27.1 per cent (3.8 bushels) in favor of contouring.

"Sorghum Grain Yields in Bushels Per Acre Obtained on the  
Basin Project Plots at Garden City, Kansas in 1944  
and an Average of the Last Five Years' Results

Cultural treatment	1944	5-year average
44-inch listed rows, continuous cropping		
Basined on contour.....	24.4	15.1
Ordinary list on contour.....	41.7	21.6
Basined up and down slope.....	26.0	12.8
Ordinary list up and down slope.....	41.2	14.7
88-inch listed rows, continuous cropping		
Basined on contour.....	13.4	11.7
Ordinary list on contour.....	20.5	14.1
Basined up and down slope.....	12.5	11.5
Ordinary list up and down slope.....	17.2	10.5
44-inch listed rows on one year fallow		
Basined on contour.....	27.4	21.5
Ordinary list on contour.....	44.6	22.7
Basined up and down slope.....	24.2	16.9
Ordinary list up and down slope.....	37.1	17.2
Average of above listed groups of treatments		
Basined on contour.....	21.7	16.1
Ordinary list on contour.....	35.6	19.5
Basined up and down slope.....	20.9	13.8
Ordinary list up and down slope.....	31.8	14.1
Average.....	27.5	15.9

The above table is part of the report by A. E. Lowe.

T. W. Edminster of Blacksburg, Virginia reports: "A preliminary summary of the soil losses on the control plot area follows. It is interesting to note that soil losses were considerably higher from the wheat plots than from the corn plots on the 5 per cent and 10 per cent slopes; losses are more nearly equal on the 15 per cent slope and show a decided trend in the opposite direction on the 20 per cent and 25 per cent slopes. A number of factors contributed to this interesting relationship. The surface structure of the wheat plots broke down and became compact and impervious during the late fall of 1943. Some surface material was flaked off by frost action so that the high per cent of surface runoff caused a high soil loss. On the corn plots just the opposite occurred. The soil had just been opened up for ready intake of water through cultivation just prior to each important rain during the growing season. Since nearly all of the storms were of low or moderate intensity, the soil took up most of the rainfall and thus held soil loss to a minimum on the lesser slopes, while soil loss did exceed that from the wheat plots on the more steep slopes.

"Summary of Soil Losses on Basis of Annual Year  
January 1 - December 31, 1944  
Blacksburg, Virginia

Slope <u>Pct.</u>	Crop	1943	1944*	8-year average
		<u>Tons</u>	<u>Tons</u>	<u>Tons</u>
5	Corn	23.73	0.30	5.08
	Wheat	0.43	1.26	0.60
	Clover	0.07	0.03	0.02
10	Corn	54.63	0.40	10.61
	Wheat	0.46	2.50	1.59
	Clover	0.06	0.06	0.06
15	Corn	71.98	2.32	15.96
	Wheat	0.51	1.77	0.96
	Clover	0.06	0.02	0.02
20	Corn	75.12	5.17	16.57
	Wheat	0.14	1.69	0.54
	Clover	0.15	0.00	0.03
25	Corn	94.86	4.95	22.19
	Wheat	0.17	1.58	0.87
	Clover	0.07	0.00	0.01

"\*Preliminary"

Harley A. Daniel of Guthrie, Oklahoma reports: "The annual amount of runoff and crop yields from plots at Cherokee, Oklahoma for 1944 and the average results of 1942, 1943 and 1944 are as follows:

Item studied	Percent runoff		Grain yield of wheat (bushels per acre)	
	1944	Average <u>1/</u>	1944	Average <u>1/</u>
<u>Method of tillage 2/</u>				
Stubble mulch.....	11.77	9.91	15.7	13.2
Plowed.....	12.15	9.68	21.5	15.0
Listed.....	12.83	9.61	19.9	15.0
Basin listed.....	11.80	9.47	19.3	14.4
<u>Direction of cultivation and effect of terraces</u>				
With slope.....	14.4	11.7	17.7	14.3
Contour.....	12.3	9.9	19.2	14.9
Terrace-contour.....	9.8	7.4	19.7	14.1

1/ Three years, 1942-44.

2/ Continuous tillage.

"It is doubtful if there is any significant difference in the amount of runoff from the various methods of continuous tillage. The crop yield, however, is slightly lower on the stubble mulch land."

Richard M. Smith of Morgantown, West Virginia reports: "Soil profile samples collected from the various Experiment Station and Extension Service hybrid corn trials throughout the State were studied and results compared with the corn yields. Soil depth, erosion, organic matter, pH, and soluble phosphorus measurements have been made and in most cases these data reveal some definite reasons for the yields and the variability of yields at particular locations. Severe drought conditions in certain sections have complicated any analysis of the results and the wide differences in soils, elevations, and general climatic characteristics makes it impossible to obtain close correlations between yields and any single soil characteristic.

"The best overall relation to corn yields seems to be provided by a product of organic matter percentage and the surface soil depth. This is a rough measure of the total amount of organic matter and gives a better correlation with yield than either factor alone. pH and soluble phosphorus limitations have been revealed in a number of cases but there is only a very poor general correlation with yield."

Earl B. Kinter of State College, Pennsylvania reports: "A project on farm ponds in Pennsylvania is being formulated in cooperation with the departments of Zoology and Agricultural Engineering of the College. Work along this line in other states does not answer the many problems encountered in farm pond construction, maintenance and utilization under Pennsylvania conditions - particularly with regard to management for fish production and to watershed and site requirements. This study will also include an investigation of the utility of strip-mine areas for fish ponds. Fairly large and deep ponds result from this type of mining, but suitability of water and other conditions are uncertain."

R. E. Dickson of Spur, Texas reports: "In the feedlots at the Spur Station at the turn of the new year were 70 head of yearling steers that had an average weight of 938 pounds that up to date have never tasted grain. They were getting along toward being killer cattle. During the past 12 months they had been used in a series of experimental grazing studies on cultivated and native grass pastures and the cost gain has been very low in comparison with gains made in dry feedlots. By extending the normal good grazing period from three to four months on native grass to a good grazing period of 12 months by use of cultivated grazing crops and supplemental rough feeds, usually produced in abundance, the expensive time, labor, and feeds used in the dry lot will be reduced and profits to the producer will rise. These are the basic land use and conservation practices at the Spur Station on 1280 acres of land that are giving results both usable and used by the livestock interest of the region.

"Instead of the high 350,000 head of cattle finished in Texas the number dropped to 168,000 as a war-time measure and the recommendations of the State Planning Committee were to drop the number to 140,000 for 1945. Texas should, and possibly will in time, finish 1,000,000 head when the information pertaining to fattening cattle on crops grown in Texas are fully realized."

T. C. Peele of Clemson, South Carolina reports: "An ultra filter with a cellophane membrane was altered in such a way that the electrical resistance of Bouyoucos blocks could be measured at various tensions (pressures) without removing the block, or releasing the pressure from the filter when making the resistance readings. This equipment is being used for making calibration curves of resistance readings against moisture tension of pF so that when resistance readings are made in the field with the blocks imbedded in soil these readings can be interpreted directly in terms of soil moisture tension.

Oscar K. Barnes of Laramie, Wyoming reports: "The following is a summary of the 1944 grazing on the pitted and grooved native range pastures at Archer. The group of pastures pitted in 1942 carried 56 per cent more sheep during the 1944 season than did the non-treated pastures. The lamb gain per acre was 68 per cent greater on the pitted pastures. Even with this difference in grazing rate there was 96 per cent more perennial grass by weight left on the pitted pastures at the end of the grazing season. The stubble height left on the two major grass species at the end of the season was 30 per cent greater for blue grama on the pitted pastures and the average stubble height of western wheat grass was 375 per cent greater on the pitted pastures.

"The group of pastures started in 1939 carried 44 per cent more sheep both on the grooved at two feet intervals and pitted range in 1944 as compared to non-treated range. The grooved pasture produced 26 per cent more lamb gain per acre than the non-treated and the pitted range 38 per cent more. There was practically no difference between any of these pastures as to amount of grass left at the end of the grazing season. The same is true of the leaf height left on blue grama, although the stubble height left on western wheat grass was considerably higher on both the treated pastures."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Land-Use Studies

North Appalachian Experimental Watershed at Coshocton, Ohio -

L. L. Harrold reports: "From the 11th to the end of the month of December there was a continuous cover of snow on the ground of 4 to 8 inches. On December 25, over 1/2 inch of rain fell on the snow at slow rates. No runoff resulted, as the soil took up what the snow was not able to absorb. Snow-density observations made on December 29 showed that the water equivalent of 1 inch of snow amounted to 0.19 inch of water. With an average snow depth of 6 inches over the experimental area there was 1.14 inches of water on the ground surface on December 29.

"The greatest depth of frost penetration for the month was 1.5 inches for wheatland on December 4 and 5. Due to the snow cover which prevailed from December 11-31, the frost never exceeded these values. Most of the time only traces of frost were found under the snow cover. On December 30 there was 1 inch of frost on the wheat and only traces of frost in the meadow. The minimum soil temperatures at watershed 109 for the 6-, 12-, and 24-inch depths were 30, 33, and 35 degrees F., respectively. The relative high soil temperatures in comparison with an average air temperature for the week of 24 degrees reflects the insulating effect of the snow cover.

"There was no runoff for the month. The moisture added to the soil was very valuable in helping to alleviate the extremely dry soil condition.

"Mr. Harrold met with the other Research Project Supervisors December 13-15, at which time we assisted in establishing time priority categories for cropland areas in Land-Use Capability Classes II to VII. Our research information was of particular value in establishing 'yardsticks' for values of rate of capability deterioration for cropland throughout the Indiana and Ohio sections of the region."

"Much progress was made in the compilation and typing of past records. Also considerable progress was made on the analyses of records for peak flows and runoff yields. A report 'Pertinent Findings from Ohio Soil Conservation Research,' prepared jointly with H. L. Borst of the Zanesville Station and R. E. Yoder of the Ohio Agricultural Experiment Station was presented December 1 at the Columbus meeting of State Operations personnel."

Hydrologic Studies at LaFayette, Indiana - R. B. Hickok reports:

"Precipitation totaled 1.10 inches on the Throckmorton farm and 1.46 inches on the Dairy farm. December 'normal' for the vicinity is 2.67 inches. Most of the precipitation was snow and there was no runoff from the experimental watersheds. Although precipitation was extremely low, temperatures have been low for December and an unusual amount of snow accumulated on the ground."

"Agronomy Mimeographed Circular #61, 'Improved Practices Reduce Loss of Available Nutrients,' by Bedell, Kohnke and Hickok, was issued by the Purdue Station. This release reports results of the soil and fertility loss studies on 2 pairs of watersheds one of which has completed the 3-year rotation (C-W-M) under conservation treatment and the other under prevailing treatment. N, P, and K losses in runoff are covered in detail and other data included are water losses, organic matter losses, and crop yields."

"The writer spent December 13 to 15, in Milwaukee with other Research Supervisors in the Region consulting with the Regional Project Plans and Conservation Surveys Division on assignment of time priorities for Operations work by Land Resources Areas. Special attention was given to estimating soil deterioration rates in relation to effective soil depths in the various Areas. Final determinations of priorities were completed by the Regional Office technicians."

Hydrologic Studies at East Lansing, Michigan - R. G. White reports: "Precipitation for the month of December amounted to 0.94 inch at the cultivated watersheds, 1.35 inches at the stubble-mulch plots, and 1.13 inches at the wooded watershed.

"During December snow fell on unfrozen ground, so that by the end of December, there was very little frost in the ground even though temperatures were not above 32 degrees after December 6, and were zero or below on four occasions. At the end of December, frost had penetrated to a depth of 6 inches under a 4-1/2-inch blanket of snow, but there was no frost in the ground at all where the snow blanket was 8 inches deep or deeper. A snow survey at the end of December indicated that there was 1.06 inches of water on the cultivated watersheds in the form of snow.

"On December 13, 14, and 15, Robert G. White attended a meeting in Milwaukee, Wisconsin, which was called by Mr. Musser to have Research men in the region assist in working out Time Priority Areas for soil-conservation work. The primary function of Research at this meeting was to supply information as to the rate of deterioration of land under its present cropping conditions. Detailed calculations were made for soils represented by the Missouri, Iowa, and Illinois Experiment Stations to serve as an index or guide in determining the deterioration for areas on which there was less information available."

Hydrologic Studies at Ithaca, New York - John L. Lamb, Jr., reports: "Weather conditions were severe during this period. Temperatures ranged from a maximum of 48 to 32 degrees and a minimum of 22 to a minus 6 degrees. With the exception of 2 days of moderation, temperature drop was most consistent from the first to last of the month. Snowfall for the month was 22 inches with an equivalent water content of 3.10 inches.

"With this snow blanket, soil was not frozen, resulting in continuous low flows even though air temperatures were in the minus stage. A combined rain and snow on December 8 upped the peak runoff stage to 0.0023 cfs per acre on both idle and woodland areas.

"Much data have been published on runoff from rainstorms of high intensity on varying soil, topography, cover, and farm practices. Very little data, however, are available on winter runoff due possibly to the difficulty in securing the data. These data are now becoming available, and with improvement in methods to overcome snow and ice accumulations, and the time element of accumulated data, greater accuracy and normal trends are anticipated."

"Due to winter conditions, annual runoff for 1942 through 1944 has been recorded for two watersheds only - 18 acres of idle land in weeds, and 18 acres in woodland (deciduous predominating), both on Volusia soil with similar slope characteristics. Data for 1942 are given in the following table. The 1943 and 1944 data are in the process of calculation and will be available later on a seasonal basis for better comparison."

Runoff, 1942

Date	Idle Land in Weeds				Woodland			
	Precip- itation	Snowfall Depth	Runoff	Precip- itation	Precip- itation	Snowfall Depth	Runoff	Precip- itation
1942	Inches	Inches	Inches	Percent	Inches	Inches	Inches	Percent
Jan.	1.59	9.25	0.32	20.0	1.59	9.25	0.76	47.8
Feb.	2.70	28.13	.29	10.6	2.70	28.13	2.47	91.6
Mar.	4.47	23.38	3.95	89.3	4.47	23.38	5.15	115.0
Apr.	2.02	6.00	1.43	70.7	2.43	6.00	2.13	87.7
May	5.15	—	1.23	24.9	5.01	—	1.22	24.4
June	3.04	—	0.53	17.3	3.18	—	0.20	6.4
July	5.52	—	.46	8.3	5.43	—	Trace	0.0
Aug.	8.84	—	4.45 <sup>2</sup>	50.3	7.27	—	2.24 <sup>2</sup>	30.8
Sept.	4.65	—	1.17	25.2	5.33	—	0.59	11.1
Oct.	3.96	—	1.40	35.4	4.16	—	1.68	40.3
Nov.	3.60	2.75	1.37	38.0	3.72	2.75	2.20	59.2
Dec.	5.33	20.00	1.83	34.3	5.33	20.00	2.86	53.8
Total	50.87	89.51	18.43	36.2	50.62	89.51	21.51	42.5

Snow Cover

Date	Idle Land in Weeds		Woodland	
	Depth	Water Equiv.	Depth	Water Equiv.
1942	Inches	Inches	Inches	Inches
Feb. 2	9.8	2.53	16.14	4.05
Mar. 2	5.7	0.27	14.70	2.93
Mar 13	0.0	0.00	12.70	3.64
Apr 15	0	0.00	Small Areas	0.00

<sup>1</sup>/ Station readings. Equivalent water content included in monthly precipitation.

<sup>2</sup>/ High intensity storm August 13 - 6.25" in 9 hrs., 3" of which fell in one hour. See Cornell Bulletin 811, page 17.

"Subsequent data may indicate that in snow infested areas, winter and especially spring runoff from the snow pack will determine the runoff coefficient rather than runoff from high intensity summer storms, if structures are to be designed for adequate capacity."

Hydrologic Studies at Cherokee, Oklahoma - H. A. Daniel reports: "Precipitation for the month was 2.09 inches. The majority of this precipitation occurred December 4 and 5 and there was considerable runoff from the plots and watersheds."

"The tillage methods are rotated annually on the watersheds and the annual amount of runoff and crop yields from these areas are as follows:

Method of Tillage <sup>1/</sup>	Runoff (percent)		Grain Yield - Wheat (bushels per acre)	
	1944	Average <sup>2/</sup>	1944	Average <sup>3/</sup>
Basin listed	12.75	8.44	17.6	13.2
One-way plowed	11.43	9.94	21.9	15.3
Stubble mulch	13.20	8.09	16.1	13.1

<sup>1/</sup>Tillage practices rotated annually, but all cultivation is on the contour.

<sup>2/</sup>Two years - 1943-44.

<sup>3/</sup>Three years - 1942-44

"In these particular areas, the highest yield to date has been produced on the one-way plowed land."

Microbiological Studies at Lincoln, Nebraska - F. L. Duley reports: "The routine laboratory determinations were continued, including tests on effect of microorganisms and organic matter on stability of soil structure. Preliminary work was begun on the influence of straw-decomposition products on the growth of corn seedlings."

"T. M. McCalla attended two meetings, one a meeting of the Missouri Valley Branch of the American Society of Bacteriologists at Topeka, Kansas. A brief paper was presented on 'Soil Temperatures and Nitrification as Related to Crop Residue Disposal.' The other meeting was a conference of the Joint Committee on Nitrogen Utilization held at LaFayette, Indiana. Dr. McCalla was appointed to the Graduate Faculty of the University of Nebraska. Three members of our staff are now on the Graduate Faculty of the University."

General - A paper by W. D. Ellison entitled "Raindrops, Surface Flow and Erosion," was published in the December issue of "Soil Conservation."

Runoff Studies

Runoff Studies at Bentonville, Ark., Muskogee; Okla., and Garland, Texas - V. D. Young reports: "The mean rainfall at Bentonville for December was 2.49 inches which was .11 inch more than the Weather Bureau normal. At Muskogee it was 1.54 inches or .75 inch less than the Weather Bureau normal. At the Garland watersheds the mean rainfall was 4.35 inches.

"Some time was spent in developing and checking a template for use in reading rainfall recorded on curvilinear charts. Curves were drawn for intensity rates of 1, 2, and 3 inches per hour.

"In order to find a simplified method of computing runoff which would reduce the time of compiling, the Simpson and Trapezoidal Rule methods of computing areas of irregular figures were checked. These computations were further checked by the method outlined in Research Memorandum RS-94. The Trapezoidal Rule method, using uniform time intervals gave very satisfactory results, was as fast or faster than the Simpson Rule method, and provided data by which the same tabulations could be used for determining the maximum runoff rate with pondage correction providing the time intervals were small."

Runoff Studies at Fennimore, Wisconsin, and Edwardsville, Ill. - N. E. Minshall reports: "At the Edwardsville project the precipitation for December was 1.42 inches and for the calendar year 34.5 inches. There was a deficiency of approximately .5 inches during the last 4 months of the year. Precipitation for Fennimore for December was .96 inch and for the calendar year 36.55 inches, which is about 4 inches above normal.

"On December 13 I attended a meeting of the Committee on Hydrology of the Wisconsin River Valley and submitted a detailed report on this meeting on December 16. The present plan calls for establishment of runoff-measuring stations on 3 or 4 areas ranging in size from 300 acres to 12 square miles."

Runoff Studies at Danville and Blacksburg, Virginia - T. W. Edminster reports: "Approximately one week was spent in bringing up-to-date, organizing, and analyzing soil and water-loss data to serve as a basis of a special report to M. W. Lowry of the Regional office on 'Rates of Deterioration for Problem Areas.' This report, based on soil and water-loss data from the Blacksburg station, dealt primarily with the Appalachian Mountain Limestone Valley and Blue Ridge Mountain areas. Estimations for the Piedmont area were referred to the Statesville, North Carolina, figures.

"A sample copy of a proposed Quarterly Selected Bibliography for use by Virginia Operations men, was completed and sent to Washington for approval. This proposed release is another of a series of steps being taken to bring Operations and Research into closer and more profitable contact with each other. With this same purpose in mind, the Project Supervisor attended a meeting of the Virginia District Conservationists. He outlined at that meeting some of the proposed projects and studies to be undertaken. Many very favorable comments were received and a definite spirit of cooperation from the field was expressed."

Runoff Studies at Colorado Springs, Colorado - H. K. Rouse reports: "On this project precipitation, all in the form of snow, occurred early in the month. Amounts ranged from 0.07 inch to 0.24 inch on the several watersheds. At the end of the month the ground was bare except for small sheltered spots. There was no runoff. Although no subzero weather was recorded, mean minimum temperatures for December were at a new low for the 6-year period of record.

"An investigation was started to determine the practicability of applying probability methods to a modified version of a wheat yield formula developed by H. H. Finnell in connection with long-time precipitation records."

Runoff Studies at Albuquerque and Santa Fe, New Mexico, and Safford, Arizona - J. H. Dorroh, Jr., reports: "Precipitation during the month was near to above normal at all watersheds, ranging from 94 percent at W-I Safford to 200 percent at the areas near Albuquerque. The fact that average December totals are characteristically low, however, minimizes the importance of those above-normal percentages. With the close of 1944 the annual totals more or less reflected the trends by months; i. e., accumulated amounts at none of the watersheds was exceptionally unusual with above-normal totals at the watersheds near Albuquerque and Santa Fe and normal to subnormal totals at the watersheds near Safford. The following table affords a resume of these data:

<u>Watershed</u>	<u>Dec. 1943</u>	<u>Dec. 1944</u>	<u>% of Normal Dec., 1944</u>	<u>Accumulated 1944</u>	<u>% of Normal</u>
W-I Safford	0.89	0.72	94	8.51	89
W-II Safford	.73	.89	116	8.95	94
W-IV Safford	.74	.75	97	9.07	95
W-V Safford	.88	1.44	153	11.95	100
Albuquerque	1.37	.78	200	10.32	121
W-I Santa Fe	1.40	.86	173	15.73	109
W-II Santa Fe	1.52	.86	123	18.09	126
W-III Santa Fe	1.50	1.14	163	17.63	123

"A start was made on editing material for preparation of a proposed Regional Technical Bulletin."

#### Hydraulic Studies

Hydraulic Studies at Minneapolis, Minnesota - F. W. Blaisdell reports: "The SAF stilling-basin study was reopened long enough for three tests to be made in order to show the effect of changing the location of the wingwalls. The wingwalls were originally located at right angles to the centerline of the basin. This location produces entirely satisfactory results but questions were raised as to whether some other location might not be equally as good or better. The first change was to locate the wingwall at 45 degrees to the basin centerline. The result of this test was equally good scour condition although a slightly higher boil was present. Indications are that the stilling basin can be set further into the dam fill if this arrangement is used. The wingwall was next located parallel to the basin centerline as an extension of the stilling-basin sidewall.

The boil height was much higher for this arrangement and there was less energy dissipation close to the stilling basin. The scour pattern was satisfactory and the structure was in no danger of being undermined. This wingwall location is recommended for use only where a wingwall located at 45 degrees or 90 degrees to the basin centerline cannot be used.

"Mr. Donnelly continued his preliminary experiments and studies of a outlet for rectangular spillways. The comments made last month are still valid but rather than attempt to develop two designs, one for high tailwater conditions and one for low tailwater conditions, it may be possible to develop a single design using as variables in the design-equation ratios of basin length and tailwater depth to the critical depth."

Hydraulic Studies at Stillwater, Oklahoma - V. J. Palmer reports: "Calculation of the previous fall's data from tests on vegetal-lined channels continued. Legends were prepared for the many photographs obtained as a detailed record of the experimental work. The revised manuscript, containing the Spartanburg vegetal-channel data and results, has been completed and returned to Dr. Nichols' office.

"Several pitot tubes were rated and the reduction made of recent velocity measurements. These measurements were taken first in the unit channels lined with love grass where it was apparent that quite uneven transverse-velocity distributions existed. They were continued in the large Bermuda-lined channel L-1 with particular study of the vertical velocity distribution.

"The field work consisted of manuring the large field-size channels FC-1 and FC-2 which are to have linings of a grass mixture and love grass, respectively. Low fertility has hindered the establishment of covers suitable for testing."

Hydraulic Studies at Logan, Utah - C. W. Lauritzen reports: "Permeability and shrinkage measurements were continued. Lining tests were continued also. Permeability data were obtained for a mixture of sandy loam and bentonite 5 percent by weight. A report was prepared on the seepage losses from the Paradise Irrigation Company Canal.

"At the invitation of the Office of Operations, C. W. Lauritzen presented 2 talks at a Northern Utah In-Service Training Meeting held in Salt Lake City, Utah, December 9, 1944. Titles of the talks were as follows:

'Resumé of Soil Conservation Service Research Division Projects and Results in Utah,' with special emphasis on current, future, and past irrigation research.

'Description of Clay Ditch Lining Results, Work Completed at Delta,' probable future use of clay for ditch lining, costs, methods found successful and those found unsuccessful."

Hydraulic Studies at Prosser, Washington - Stephen J. Mech reports: "Calculation and tabulation of 1944 data in preparation for various reports was the principal work of the month. The corn-plot yield data were calculated after the corn was shelled and oven dried. The yield in the following table is expressed as No. 1 corn with 14 percent moisture:

1944 CORN PLOT DATA  
Showing effect of application rate on stand and yield

Rate of Irrigation Application	Stand Count			Yield in Bu/Acre			
	Entire Plot	Upper half	Lower half	Entire plot	Upper half	Lower half	Lower as % of upper
Contour Plots (2% Furrow Grade)							
q	1385	717	668	90.9	98.8	83.0	84.0
2q	1372	676	696	95.8	97.0	94.6	97.5
3q	1330	668	662	93.9	96.6	91.3	94.5
Totals	4087	2061	2026	93.6	97.5	89.6	91.9
Downhill Plots (7% Furrow Grade)							
q	1413	721	692	89.3	101.7	76.8	75.6
2q	1367	647	720	92.5	99.8	85.2	85.4
3q	1379	649	730	96.4	102.0	90.8	89.0
Totals	4159	2017	2142	92.8	101.2	84.3	83.2

Note:

"q" is that rate of application which will reach the bottom of a 250 ft. furrow in about 2 hours. It is adjusted as necessary to maintain a sustained trickle of runoff. '2q' and '3q' are at all times 2 and 3 times as great as 'q'.

"The contour plots produced .98 ears per plant on the upper half of the plot and .90 on the lower half. The downhill plots produced .96 and .91 ears per plant on the upper and lower half of the plot respectively.

"These data show practically no difference between the average yields on the contour and the downhill plots.. This indicates, at least on a short-time basis, that as long as the water is made available to the plant, it matters not how it is applied.

"Soil-moisture samples showed a variation between the total and distribution of the soil moisture added to the root zone by the different rates of application. The yields reflect this only in a slight degree except on the 'q' plots where the amount of moisture received by the lower half of the plot was a limiting factor. (November report contains moisture data.)

"The consistant lower yield on the lower half of the plots emphasizes the desirability of evaluating the cause or causes of this persistent adverse comparison. It indicates also what crop increase may eventually be obtained if the crop yield on the lower part of such fields is raised to that on the upper half."

Hydraulic Studies at the California Institute of Technology, Pasadena, California - Vito A. Vanoni reports: "Correspondence from the Regional Office at Fort Worth indicates that it will be possible to start a series of spillway-model studies in January and February. This series will include about nine spillways which have been in operation for several years and are showing structural and hydraulic defects. The problem of the model study in general will be to find out how to modify the existing structures so that they will operate satisfactorily without excessive expenditures."

### Sedimentation Studies

C. B. Brown reports: "A report entitled 'Rates of Sediment Production in Southwestern United States', SCS-TP-58 was made available for distribution at the end of the month. This report was described in the August Research Summary pp. 20-21.

"A 'Report on an Investigation of Water Losses in Streams Flowing East Out of the Black Hills, South Dakota', Sedimentation Sec., Special Rept. No. 8, was also made available for distribution. This report discusses the engineering and economic feasibility of sealing the beds of 6 streams in the Black Hills with impervious material to minimize water losses, and thereby to increase the flow available for irrigation and maintenance of fishing resources.

"Considerable time was spent in developing information on the relation of soil erosion and conservation to public water supply. State census reports on public water-treatment plants, recently issued by the United States Public Health Service, have made available a fund of valuable data. An analysis of these data show that approximately 32,000,000 urban residents, or slightly more than the entire farm population of the country, are served with treated surface water from which the products of soil erosion - the sediment load - must be removed at a cost of some tens of millions of dollars annually. A large number of urban communities are also paying additional taxes or increased costs for water as a result of silting in municipal water-supply reservoirs. Conservation on municipal water-supply watersheds would be a prudent investment for many cities. Cooperation with the soil-conservation districts offers a means for city-water-shed protection that heretofore has not been available to most cities. A report analyzing the situation in Region 3, with particular reference to Illinois and Iowa, was prepared and submitted for consideration of the Regional Staff. An article discussing water supply and other enterprises affected by soil erosion was published in the December issue of Soil Conservation under the title 'Downstream Interests.'

"New data were developed by Mr. Gottschalk on silting at the head of Chesapeake Bay. A comparison of U. S. Coast and Geodetic Survey Charts of 1846 and 1938 shows that in the upper six miles of the Bay, below the mouths of Susquehanna and Northeast Rivers, 52,575 acre-feet of sediment was deposited during the 92-year period. This reduced the volume of water in this 32-square-mile segment of the bay by 36 percent and reduced the average depth by 2-1/2 feet. New land comprising 787 acres was raised above mean low tide and added to the State of Maryland. The

:improvement and maintenance of navigation channels into Havre de Grace and other ports at the head of the bay has cost the Federal Government \$377,000 to 1943. Silting in Chesapeake Bay has also caused serious effects to oyster resources, and in places has increased the hazards of shore erosion. Wide interest continues to be manifested in these sedimentation studies in Chesapeake Bay and its harbors. An extensive digest of our findings on Baltimore Harbor and Baltimore's reservoirs was included in the 1944 Annual Report of officers and chairman to the Maryland Congress of Parents and Teachers. Conservation is being widely emphasized in Maryland elementary and intermediate schools. In Montgomery County, it constitutes the entire sixth grade social studies program. Five hundred reprints of the article by Mr. Gottschalk 'Sedimentation in a Great Harbor' from 'Soil Conservation' were ordered by State officials to be placed in the hands of State teachers concerned with conservation education."

Sediment Studies at the Cooperative Laboratory, California Institute of Technology, Pasadena, California - Vito A. Vanoni reports: "Considerable time was spent in preparing a 10-inch flume for sediment transportation experiments with abnormally high rates of transportation. Studies of several stream-control problems in Southern California indicate that the rates of transportation in these streams are considerably above any rates covered by laboratory experiments. Therefore, the laboratory data cannot be applied direct to these problems. In attempting to extend the laboratory experiments to the higher rates of transportation, certain experimental difficulties are encountered which must be overcome. Among these is the measurement of the slope made extremely difficult because of characteristic sand waves and the measurement of the rate of flow. Progress is being made on solving these difficulties.

"A work plan was prepared covering stream-bed scour measurements in the Simi Wash.

"Considerable interest is being shown in density currents by the Fish and Wildlife Service in the U. S. Department of the Interior. The Portland office has borrowed several films on this subject and several exchanges of correspondence between offices has occurred in which a number of technical points were discussed.

"Progress was made on the installation of more facilities and apparatus for a revetment study. A work plan covering this study was prepared."

#### Drainage Studies

Drainage Investigations at St. Paul, Minnesota - D. G. Miller reports: "During this period Mr. Wiberg and I completed testing the more than 700 experimental concrete cylinders we dug up in Minnesota and Wisconsin earlier this fall. Testing these cylinders and calculating and tabulating the results occupied most of our time for the month. We now are revising a number of the line drawings that Mr. Manson had so carefully prepared for the report, based on the tests at 10 years. When these were drawn last summer, we had expected that the 20-year tests would cause a few changes but had not anticipated that the changes would be as numerous or as radical as they will be. I feel that the report is going to be a good report although it is not going to be too good for concrete drain tile in peat."

The Everglades Project at Ft. Lauderdale, Florida - C. Kay

Davis reports: "We made an attempt this month to complete a survey line across the Loxahatchee Peat area north of the Hillsboro Canal but were unable to get through. The old trails are now so grown up with sawgrass and other vegetation that it is impossible to see for any appreciable distance without so much cutting that we have decided to wait until the water level is higher in this area when we can cut a line through the airboat.

"We will concentrate our work south of the Tamiami Trail during the month of January so as to complete that portion of the Everglades south of Lake Okeechobee in time for making a topographic map of this area for our Project report. We will need one line through the Cypress area north of Tamiami Trail but will need a Glades buggy for travel in this area. We have started this week with the construction of the Glades buggy, and that will be an improvement over any such vehicles as we have constructed in the past and I believe will be practical for travel in areas where we have not been able to go heretofore."

## IRRIGATION DIVISION

### Water Requirements for Irrigation

#### Evapo-Transpiration Losses

Santa Ana River, Prado, Calif. Harry F. Blaney, Los Angeles, Calif., reports that the data to be included in the 1944 progress report to the Orange County Water District was discussed with representatives of the U. S. Geological Survey at a joint meeting in Pomona. It was decided that each phase of the investigation would be discussed in a separate chapter. Dean Muckel has completed the chapter assigned to him on "Consumptive Use of Water." Willis Barrett reported that his chapter on analysis of ground-water fluctuations would be completed early in January. As soon as chapters dealing with streamflow and underflow are completed by members of the Geological Survey staff, a joint introductory chapter will be prepared.

San Luis Rey River, Calif. Dean C. Muckel and Harry F. Blaney, after reviewing the three previous progress reports covering the San Luis Rey River water utilization studies, decided to combine and rearrange them for a final report in cooperation with the State Engineer of California.

Estancia Valley, New Mexico. At the request of the Albuquerque Regional Office, Harry F. Blaney prepared a memorandum on proposed joint evapo-transpiration and irrigation-requirement studies in Estancia Valley.

#### Irrigation Requirement Report, California

A. A. Young, Willis C. Barrett, and H. F. Blaney reviewed some of the available data and began development of a procedure for compiling records of irrigation requirements and consumptive use of water.

#### Evaporation from Water Surfaces

A. A. Young has completed his report on "Evaporation Investigations in Southern California," and the report is being mimeographed in Berkeley. It includes results of a 5-year study involving comparison of evaporation from pans of different diameters, from all standard pans, and establishes coefficients for conversion of pan evaporation to equivalent lake or reservoir evaporation in areas where similar climatic conditions exist. This is the fourth report by Mr. Young, having to do with evaporation.

Carl Rohwer prepared a discussion of the article on "Evaporation from a Free Water Surface," by Mr. Hickox, for the American Society of Civil Engineers.

### Cooperation with U. S. Bureau of Reclamation

Reclamation projects in the Northwest. During the past 2 months, Wayne D. Criddle, on detail to the U. S. Bureau of Reclamation, studied infiltration rates, surface waste, and water use on various reclamation projects in the Northwest, and compiled and analyzed all available data. Getting the irrigation water into the soil is a serious problem on several of the newer Bureau of Reclamation projects. Apparently the soils on the Owyhee Project, the Payette Division of the Boise Project, and the Rosa Division of the Yakima Project are in a highly deflocculated state. Soils which to all appearances are of a sandy-loam texture take water very slowly. Many of the farmers run water continually for six weeks to two months on their potato fields, and tests seem to indicate that slightly over 12 acre-inches per acre gets into the soil each month under this continuous irrigation. Some of the lands are relatively steep, slopes running up to 10 percent or more. Under these conditions it is not uncommon to see furrows a thousand feet long with less than a gallon per minute flow at the head and 50 percent surface waste from the end of the furrow. It is believed the permeability of the soil will increase after some years of cultivation and irrigation. A program is being set up to determine the best cultural practices to increase the infiltration rate. Various chemical treatments are also being tried.

### Water-Supply Problems in Bitterroot Valley, Montana

J. S. James reports that the Bitterroot Soil Conservation District has requested a study of the water-supply problem, particularly that of lands served by certain west-side tributaries, to provide a basis for both group and individual farm planning. As a first step toward meeting that request, Mr. James has undertaken to assemble all available information of possible use in initiating plans for a progressive development. Such planning would probably be done in coordination with plans of the Bureau of Reclamation and the State Water Conservation Board.

### Hydraulics of Irrigation

#### Design and Invention

R. L. Parshall reports that studies have been concluded on the model riffle - metal vane - deflector sand trap at the hydraulic laboratory. It was determined that use of three sets of deflectors, placed 4 feet apart in the prototype structure, gave an efficiency of about 85 to 90 percent for both samples of coal and sand for a full-scale velocity of flow of 1.5 feet per second. It is likely that under actual field operation the efficiency will be relatively high. This type of sand trap is intended to operate under low to moderate velocities, with upper limit about 2-1/2 feet per second. For conditions where very fine material is to be captured, the length of structure should be increased and more sets of riffles provided and the width of channel made proportionately greater to effect

a low velocity through the structure. The maximum width of channel probably should not exceed 12 feet, being therefore best suited to flows not exceeding 50 second-feet.

The model has been removed from the laboratory setting and reconditioned, altered by the substitution of a curved entrance section, repainted, and the model copper deflector vanes permanently set on the floor of the small structure. It is the intention to send this model to the Portland Regional Office for the purpose of acquainting the engineers there with this type of sand trap and also to permit further tests, if desired, to verify the conclusions reached at Fort Collins.

This device has merit and should operate successfully in the field, although somewhat limited in its application. It possesses at least one disadvantage - that is, trash and rubbish will be caught in the vanes and thus materially reduce its efficiency.

#### Investigation of Sources & Storage of Irrigation Water

##### Snow Surveys & Irrigation Water-Supply Forecasts

R. A. Work reports completion of a report on the subject of application of snow surveys to operations of soil-conservation districts. The committee which prepared the report recommended a campaign of education to acquaint soil-conservation district personnel with the objective and operations of the snow surveys, in the belief that many more districts would benefit from the periodic water-supply forecasts if they were better informed as to their scope and potentialities.

Carl Rohwer reports revision of the monthly forecasts so as to make them more useful and easier to understand.

Everett H. Davis reports a study of runoff data on 21 drainage areas in Colorado, Wyoming, and New Mexico as a basis for collaborating with the Forest and Range Experiment Station in evaluating the water on a per-acre basis for each of the drainages. Irrespective of the size of the drainage area involved, the annual runoff per acre on 80 percent of the drainages was less than one acre-foot (usually from 0.5 to 0.95) for the four years 1939 to 1942. The areas of the 21 drainages varied from 14,900 acres to 1,843,200 acres. At the same time the runoff data and areas of drainage were being assembled and correlation curves were prepared, for the Division's use in future forecasting, showing the relation between water content of snow cover on established snow courses and the annual runoff.

J. C. Marr reports that the Boise office was asked to be represented at a hearing to gather testimony regarding flood hazards on Boise River. At the hearing Colonel Tudor explained a tentative flood-relief construction plan which the Army Engineers were investigating. This plan involves the construction of a large dam on Boise River at Lucky Peak, and operation of the new dam together with Arrowrock and Anderson Ranch Dams as flood-control structures in a manner which would not impair the supply of water for irrigation. The whole plan depends upon the ability of the Irrigation Division to forecast the spring runoff. This ability was not questioned since the forecasting of the runoff of Boise River has been sufficiently accurate for this purpose for the past 10 years. While Colonel Tudor was in Boise, he was asked to help our snow-survey work by making available to us an Army Cargo T-15 Snowmobile. This he promised to do for us if possible but without results so far.

Storage of Water Underground for Irrigation:

San Joaquin Valley Cooperative Investigation. A meeting of the Central Valley Waterspreading Committee was held in the Berkeley office on Dec. 16. The accomplishments made during the past eight months of field and laboratory study were discussed, together with plans for continuing the work. It was decided that a progress report be prepared by each cooperating agency covering its part in the program, these reports then to be summarized with recommendations for future procedure by a subcommittee composed of a representative or representatives from each agency. Fred C. Scobey and Dean C. Muckel were named by Mr. McLaughlin to represent the Division of Irrigation. At the meeting of the committee Mr. Scobey presented replatted charts showing the performance of the ponds, the revision serving to assemble all ponds of each group on single sheets. Subsequently he carried the work further for submission to the subcommittee which will recommend procedure for 1945. Until the progress reports are available and are reviewed by the committee the program is to be continued without change. Thirty-one ponds were in operation during the month of December, but 13 were operated only a short time. Water has been supplied to one pond uninterruptedly for 250 days (as of January 1).

A. A. Young reports that permeability tests were continued at the Riverside Regional Salinity Laboratory without such change in the existing set-up except some reduction in the number of cores under investigation. Permeability rates become fairly well established after a sufficient period has elapsed for removal of air entrapped in the soil and in their final phases go through a slow decline that plots a curve approaching the horizontal.

Santa Ana River. D. C. Muckel reports that diversion of Santa Ana River water for spreading purposes started November 14 and has continued to date. The amount diverted has not been large, averaging about 20 second-feet.

Antelope Valley. Mr. Muckel reports that a test basin has been completed on Kings Canyon debris cone in Antelope Valley to determine the rate of percolation. Water is being taken from the Owens River Aqueduct by a siphon for the tests. The initial percolation rates were reported to be in the neighborhood of 12 feet a day. The Office of Operations is doing the actual construction and operation of the tests in consultation with the Division of Irrigation. Water-stage recorders and other equipment were furnished by the Division of Irrigation.

Simi Valley. Mr. Muckel reports that the possibility of improving the ground-water supplies of Simi Valley by spreading tributary flows was discussed with representatives of the Office of Operations. The area at the mouth of Mair Canyon which has been recommended as a spreading area by a local consulting engineer was inspected. It appeared to have possibilities but additional exploration of the underlying material is needed before developing a spreading grounds. Run-off from the canyon is flashy and the quantity of water which could be consumed is unknown.

#### Drainage of Irrigated Lands

##### San Fernando Valley Soil Conservation District, Calif.

At the request of the District and the Office of Operations, Harry F. Blaney attended a conference of representatives of the Soil Conservation Service, California State Division of Water Resources, University of California, Los Angeles County Flood Control District, and the City of Los Angeles, to discuss drainage and ground-water problems in San Fernando Valley. As a member of a subcommittee, he assisted in preparing a preliminary report on status and purpose of observations now being made by different agencies and in outlining a program for future cooperative studies. Some 60 deep wells and several shallow wells are now being measured by local agencies. It was recommended that (1) all available data on ground-water levels be assembled and analyzed; (2) about 40 additional shallow observation wells be established; (3) effect of deepening of the Los Angeles River channel on high water table be studied; and (4) the Soil Conservation Service coordinate measurements of depth to ground-water level in all old and new observation wells in the District.

##### Imperial Valley, California

Harry F. Blaney conferred with Evan T. Hewes, President of the Board of Directors, and M. J. Dowd, Consulting Engineer, of the Imperial Irrigation District, regarding the proposed ground-water studies along the All-American Canal, East Mesa and West Mesa.

V. A. Aronovici reports that a series of "in-place" and "packed" permeameter runs were completed and tabulated. Duplicate runs further indicated the reliability of the technique employed in establishing the coefficient of permeability. Evidence was also brought out to indicate that the relationship between in-place and packed samples is not always consistent even when field conditions suggest that they should be so. Further investigation of this relationship is in order and a large number of observations is highly desirable. \* \* \* Although it has been found impractical to observe the rate of uptake of soil samples to the point of ultimate equilibrium, the sorption curves of 24 soil samples under decreasing tension and brought near equilibrium will prove of practical value in field application. This work has required more than 6 months and is now completed. Observations were made by means of the Shaw-Leamer tension table and included tensions of 2 feet and less above the water table. At present we are not equipped to study materials under higher tension over prolonged periods of time. A desorption curve will now be determined on the same samples up to the maximum tension of 2 feet. This will require much less time as samples release moisture much more rapidly than under sorption conditions.

W. W. Donnan reports that on the Nelson Correll project, water-table levels adjacent to an open drain continue to stay low despite frequent irrigations. The plot is now being cropped to coriander. A summer leaching program and irrigations on October 8, November 9 and December 20 plus 1-1/2" of rain have only brought the water table from 7 feet to 5.75 feet at the highest point - a rise of 1.25 feet. This would indicate that the drain is functioning quite satisfactorily and supplementary tile lines might not be needed. The crop, which is about as salt tolerant as flax, has attained a moderately good stand as against a past crop record of complete failure on this plot.

#### Seepage Losses Affecting Irrigation Practices

Carl Rohwer revised the report on "Seepage from Canals and Methods of Prevention" prepared last year and gave attention to plans for presenting the data on permeameters which was objected to in the original report prepared by Major Stout some years ago. Because of the difficulty in making seepage measurements by means of current meters and the drop in pools, more attention has recently been given to the use of permeameters which give direct readings of the loss in a definite area under operating conditions of the canal. If the method can be perfected it will simplify the procedure in locating the sections where the losses actually occur.

A report was submitted by Mr. Rohwer to the Pacific Coast Region Office of Operations, on the seepage problems of the Juniper Flat District in Oregon.

Irrigation Institutions

Water Supply, Storage and Conveyance Facilities of Utah Irrigation Companies.

J. H. Maughan reports that work on the Utah Irrigation Company survey has been mainly in the field, contacting irrigation-company leaders and filling out data sheets for the companies. This work has been initiated in all counties and about half of them have been completed. In general the completed sections are the outlying areas which were worked during October and November.

Hawaii Water-Law Studies

Wells A. Hutchins reports that the studies of Hawaii ground-water law problems were continued in the Territory of Hawaii during the first half of December. Most of the time was spent on the Island of Oahu; a plane trip was made to the Islands of Molokai and Maui, one day being spent on the former and two on the latter. Conferences were continued with interested parties, including the Governor, Attorney General, and a group of Navy officers at Pearl Harbor. The first draft of a suggested Territorial statute for the control of withdrawals and uses of ground waters was prepared and left with the Honolulu Board of Water Supply for circulation among local attorneys, geologists, and engineers. Mr. Hutchins left Honolulu by clipper December 16 and arrived in Berkeley the next day.